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Identification and Prioritization the Risks of Green Building Projects Based on the Combination of FANP and FDEMATEL: (Case study: Savadkooh County)

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ABSTRACT: Green buildings are consistent objects which consider environment issues and natural resources throughout their life cycle. The risks on green construction projects reduce the accuracy of the estimation of the projects objectives and reduce the efficiency of green building projects. Therefore, identification and prioritization of risks can play a significant role in the success of green construction projects. In this research, a comprehensive model of all criteria and indicators of the risks for green construction projects are presentedAt first step, the indicators have been evaluated and ranked first by fuzzy Delphi technique by the identification and verification experts, and then by combining the results of the network analysis process and the DEMATEL technique in fuzzy conditions. Finally, the final ranking of the indicators is done according to the results obtained in the super decision software. in fuzzy conditions to rank and evaluate the causal relationships between the factors and ultimately final prioritizing green building risk indicators have been done in terms of the results of the initial steps using the fuzzy Analysis Network Process FANP and DEMATEL technique. The results of the research showed that the risks associated with poor quality of materials and inappropriate equipment are very important and the lack of scale for the cost of activities has the least importance.

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1-Introduction

Today's, with the development of technology and the promotion of living standards as well as the increasing rise of safety, health and environmental issues have important roles. Therefore, it is necessary to apply a management and targeting tool that accurely determines and effectively controls the potential and actual environmental and safety risks in the construction projects. Since risks are an inherent attribute of all projects, it is not possible to completely remove them. It can be effectively managed to reduce the risk of projects. But its occurrence is likely to occur in at least one aspect of the project, such as scope, time, cost, or quality. Therefore, identification and prioritization of risks can play a significant role in the success of the project [1].

In today's world, the number and volume of buildings, residential and office buildings are increasing at any time. According to the statistics of urban and architectural information centers, the total area of the existing buildings in the world is about one-sixth of the water fields, including rivers, lakes, seas and oceans. More than a quarter of the land under cultivation and the forests are damaged and dried to build new homes or factories and two thirds of the building materials used in various buildings have destroyed the unthinkable energy and underground resources. If this process continues at such a pivotal pace, in the next few years, the land will no longer tolerate any human being. Because it's limited resources are completely exhausted, and there will be no effect on forests and oceans. In green buildings, the most important issue is ensuring the physical and mental health of the residents. The green building can save the earth's future, which seems to be eroding and to the next generations provide the opportunity to live with comfort and tranquility [2].

In a study by It is corrected[3]. the risks identified for green building projects are prioritized. In this research, the normality of the criteria and sub-criteria was measured using the Kolmogorov-Smirnov test and Wilcoxon test has been used to influence each of the sub-criteria. Finally, out of 37 sub-criteria, 12 criteria were effective. These 12 criteria were selected for analysis by the network analysis process method. Different matrices of internal dependence of main criteria to each other, internal dependence of sub-criteria to each other, paired comparison of main criteria based on purpose, paired comparison of main criteria with regard to their inside dependence by control of each main dimension, paired comparison of sub-criteria related to each of the main dimensions, the paired comparison of subscales of interdependence with each of the sub-criteria are formed and finally, they have prioritized with using the network analysis process. Rebecca and colleagues [4] have also discussed the issue of stakeholder involvement and their associated risks in complex green construction projects in a social networking model. In that research, a social network analysis based on stakeholders and their associated risks in green construction projects is designed. A social network model consists of stakeholders and stakeholders which there is a relationship between them. Stakeholders and dependence between risks are forming the network. They proposed a multi-criteria decision-making process to prioritize the risks. There are 7 risks associated with stakeholders.

The general objectives of this research are to identify and prioritize the risks of green building projects. In a way that

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makes it easy to understand and manage your risk effectively. Since one of the most important problems of project managers is the identification and risk management of the project. Therefore, the identification and prioritization phase of risk is an important issue in risk management. The results of this research can reduce the risks of green construction projects in the implementation phase, and in addition to efficient use of resources and the health of residents and improving the efficiency of residents has less environmental impact.

2- Methodology

The methodology of this research is the improvement of the model for identifying and prioritizing the risk indicators of green construction projects in the city of Savadkuh. The present research is based on systematic and scientific research methodology. In the first step of this study, we will study the literature and literature on the risks of green building projects. Then, information about the criteria and indicators of the risks of green construction projects are collected and, based on this, the criteria and indicators of the risks of green construction projects in the city of Savadkuh are identified. In the next step, using the Fuzzy Delphi technique, they will be filtered and screened. At this stage, effective indicators are selected and inefficient indicators are eliminated. In the third step, important indicators are categorized and categorized by experts in terms of several key criteria. Then, the pairwise comparison of the main criteria based on the objective and the pairwise comparisons of indicators is done by the experts on the basis of the relevant benchmark. Also, the Fuzzy DEMATEL technique has been used to identify and determine the internal relations between the main criteria. DEMATEL technique utilizes the principles of graph theory to extract the interrelationships and interactions of the elements in the graph, so that the severity of the effect of these relations is determined numerically. In the final step of this study, considering the priority pattern and the internal relations of the variables, the Fuzzy network analysis process will prioritize and finalize the risk indicators of green construction projects. The final results obtained from this study are presented in Table 1.

3-Results and discussion

The results of the research show that quality of materials, inappropriate equipment, unexpected delay, lack of realistic goals and internal disorder are the most important risks of green construction projects. Also, the results of Table 1 show that the quality index is the most important factor of risk and the factors of construction, management and equipment are in the next level. In this regard, the results of similar research done by Faraji Asl, to identify and prioritize the dangers of green building projects using the ANP method, indicate that the unpredictable latency index of construction dimension is the most effective component of the dangers for green construction projects. Delay in the construction of a green construction project will prolong the implementation of the contract, increase the price of raw materials and increase the cost of manpower and overhead, this leads to the high risks of green construction projects. This index is one of the main factors affecting green construction projects, which makes it as top priority in the present study. Conclusions from the results of this study indicate that the quality of materials and technical issues are as the first effective components in green construction projects in the city of Savadkuh. While the poor quality of materials used in the green building is directly related to the loss of capital and the reduction of the safety and resistance of buildings. Therefore, considering that the city of Savadkuh is exposed to natural disasters such as floods and inappropriate atmospheric conditions, this component is the highest importance from the perspective of experts.

Table 1. Ranking final risk indicators for green construction projects in Savadkuh County

Symbol	Indicator	Ideals	Normals	Raw	Rank
S11	Instability	0.4757	0.0622	0.0311	7
S12	Internal disorder	0.6565	0.0859	0.0429	5
S13	Tension in foreign policy	0.2269	0.0297	0.0148	12
S21	lack of realistic goals	0.8057	0.1054	0.0527	4
S22	Inappropriate control	0.4611	0.0603	0.0301	9
S31	Unpredictability of delay	0.8260	0.1081	0.0540	3
S32	Inadequate contractor knowledge	0.4707	0.0616	0.0308	8
S41	Exchange rate fluctuations	0.4525	0.0592	0.0296	10
S42	Inflation and rising interest rates	0.5749	0.0758	0.0379	6
S43	Incorrect payment schedules	0.1499	0.0196	0.0098	14
S44	lack of scale for operating costs	0.0999	0.0130	0.0065	15
S51	Inappropriate equipment	0.9425	0.1233	0.0616	2
S52	Inappropriate use of tools and equipment	0.2674	0.0350	0.0175	11
S61	poor quality materials	1	0.1308	0.0654	1
S62	poor construction quality	0.2254	0.0295	0.0147	13

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